Ion wave parametric instabilities.

E. A. Williams, B. I. Cohen, R. L. Berger, B. F. Lasinski and A. B. Langdon

Lawrence Livermore National Laboratory,
Livermore, CA 94550

Simulations of ion acoustic waves driven by a prescribed ponderomotive potential with our 2-D Boltzmann electron, PIC ion code BZOHAR, have shown some interesting saturation behaviour

After initial 1-D growth, the ion acoustic waves develop two dimensional, long wavelength structure and crash in amplitude.

Ion waves with k-vector one half that of the driving wave, together with a transverse k-component, are found to grow up at this time.

We have obtained the dispersion relation for the parametric coupling of the driven ion wave to other ion waves. The fastest growing branch of this instability [2,3] (with growth rate $\sim(1/4)$ δ $k_0 c_s$) is a decay into the modes observed in our BZOHAR simulations.

We present an analysis of this dispersion relation. Important features affecting the parametric instability of a driven ion wave are the driving frequency relative to the normal mode frequency and the ratio of the electron Debye length to the wavelength.

1) Resonantly Excited Nonlinear Ion Waves (submitted to Physics of Plasmas)
2) S. J. Kartunnen, J. N. McMullin and A. A. Offenberger. Phys. Fluids 24, 447 (1981)
3) W. L. Kruer in From Fusion to Light Surfing , edited by T. Katsouleas (Addison Wesley, 1991)